FY89 ANNUAL 1 Oct 88 - 30 Sept 89

Chemical Warfare and Chemical/Biological Defense Research Program Obligations

NA

NA

Assistant Secretary of the Army for
Research, Development and Acquisition NA
Washington, DC

NA NA

NA

Public Law 91-121 required the Department of Defense to make an annual report to Congress on the funds obligated for chemical warfare and biological defense research, development and procurement programs. Contents of this report include: Chemical research, defensive equipment program, chemical agent alarm technology, chemical detection and identification technology, chemical decontamination investigation, physical protection against chemical agents, remote sensing alarms, protective masks, biological research, and biological defense against biological agents.

BIOLOGICAL/CHEMICAL WARFARE, CHEMICAL AGENTS, CHEMICAL DETECTION, DECONTAMINATION, TOXIC AGENT ALARMS, PROTECTIVE EQUIPMENT, MASKS, DETECTORS, PROTECTIVE NA
CLOTHING, RECONNAISSANCE, TOXICITY, INFECTED SHELTERS.

UNCLASSIFIED UNCLASSIFIED UNCLASSIFIED UNLIMITED

DEPARTMENT OF DEFENSE
ANNUAL REPORT ON CHEMICAL WARFARE AND
CHEMICAL/BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS
FOR THE PERIOD OCTOBER 1, 1988 THROUGH SEPTEMBER 30, 1989
RCS: DD-USDRE(A) 1065

(Dollars in Thousands)

	ARMY	NAVY	AIR FORCE	TOTAL
Chemical Warfare and Chemical Defense Program	176,994	15,211	34,029	226,234
Biological Defense Program	81,522	0	0	81,522
Total Program	258,516	15,211	34,029	307,756

DEPARTMENT OF DEFENSE
ANNUAL REPORT ON CHEMICAL WARFARE AND
CHEMICAL/BIOLOGICAL DEFENSE RESEARCH HUMAN TESTING
FOR THE PERIOD OCTOBER 1, 1988 THROUGH SEPTEMBER 30, 1989

There have been no studies conducted within the Department of Defense during the reporting period that involved the use of human subjects for testing of chemical or biological agents.

ANNEX A

DEPARTMENT OF THE ARMY

ANNUAL REPORT ON

CHEMICAL WARFARE AND CHEMICAL/BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1988 THROUGH 30 SEPTEMBER 1989

RCS: DD-USDRE (A) 1065

DEPARTMENT OF THE ARMY

ANNUAL REPORT ON

CHEMICAL WARFARE AND CHEMICAL/BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

DESCRIPTION OF RDTE EFFORT FOR THE CHEMICAL WARFARE AND CHEMICAL DEFENSE PROGRAM

During FY 89, the Department of the Army obligated $176,994,000 for general research investigations, development and test of chemical warfare agents, weapons systems and defensive equipment.

FUNDS OBLIGATED

Current Fiscal Year	(CFY)	$168,897,000		
Prior Year	(PY)	8,097,000		
TOTAL		$176,994,000	In-House	$ 64,203,000
			Contract	$112,791,000

Breakdown of Program Areas

1. CHEMICAL RESEARCH

a. Basic Research in Life Sciences	CFY	$ 9,333,000		
	PY	(52,000)		
		$ 9,281,000	In-House	$ 5,844,000
			Contract	$ 3,437,000
b. General Chemical Investigations Exploratory Development	CFY	$ 6,523,000		
	PY	35,000		
		$ 6,558,000	In-House	$ 4,536,000
			Contract	$ 2,022,000
TOTAL: CHEMICAL RESEARCH	CFY	$ 15,856,000		
	PY	(17,000)		
		$ 15,839,000	In-House	$ 10,380,000
			Contract	$ 5,459,000

2. LETHAL CHEMICAL PROGRAM				
a. Exploratory Development	CFY	$ 2,799,000		
	PY	-0-		
		$ 2,799,000	In-House	$ 2,425,000
			Contract	$ 374,000
b. Advanced Development		$ -0-		
c. Full-scale Development	CFY	$ 33,308,000		
	PY	$ -0-		
		$ 33,308,000	In-House	$ 32,000
			Contract	$ 33,276,000
d. Testing		$ -0-		
TOTAL: LETHAL CHEMICAL PROGRAM	CFY	$ 36,107,000		
	PY	-0-		
		$ 36,107,000	In-House	$ 2,457,000
			Contract	$ 33,650,000
3. INCAPACITATING CHEMICAL PROGRAM				
a. Exploratory Development	CFY	$ 1,357,000		
	PY	-0-	In-House	$ 1,248,000
		$ 1,357,000	Contract	$ 109,000
b. Advanced Development		$ -0-		
c. Full-scale Development		$ -0-		
d. Testing		-0-		

TOTAL: INCAPACITATING CHEMICAL PROGRAM	CFY	$ 1,357,000		
	PY	-0-		
			In-House	$ 1,248,000
	$	1,357,000	Contract	$ 109,000
4. CHEMICAL DEFENSIVE EQUIPMENT PROGRAM				
a. Exploratory Development				
(1) Physical Protection Investigations	CFY	$ 8,626,000		
	PY	$ 26,000		
			In-House	$ 6,750,000
	$	8,652,000	Contract	$ 1,902,000
(2) Warning and Detection Investigations	CFY	$ 9,570,000		
	PY	$ 1,707,000		
			In-House	$ 4,244,000
	$	11,277,000	Contract	$ 7,033,000
(3) Medical Defense Against Chemical Agents	CFY	$ 20,627,000		
	PY	$ 1,500,000		
			In-House	$ 15,715,000
	$	22,127,000	Contract	$ 6,412,000
TOTAL: Exploratory Development	CFY	$ 38,823,000		
	PY	$ 3,233,000		
			In-House	$ 26,709,000
	$	42,056,000	Contract	$ 15,347,000
b. Advanced Development				
(1) Chemical Decontaminating Materiel	CFY	$ 3,681,000		
	PY	3,000		
			In-House	$ 287,000
	$	3,684,000	Contract	$ 3,397,000

(2) Collective Protection Equipment	CFY	$ 3,037,000			
	PY	$ -0-			
			In-House	$	444,000
	$ 3,037,000		Contract	$	2,593,000
(3) Individual Protection Equipment	CFY	$ 642,000			
	PY	$ 133,000			
			In-House	$	326,000
	$ 775,000		Contract	$	449,000
(4) Chemical Detection and Warning Materiel	CFY	$ 6,308,000			
	PY	$ 64,000			
			In-House	$	2,178,000
	$ 6,372,000		Contract	$	4,194,000
(5) Medical Chemical Defense Life Support Materiel	CFY	$ 9,630,000			
	PY	$ 1,152,000			
			In-House	$	4,183,000
	$ 10,782,000		Contract	$	6,599,000
(6) Medical Defense Against Chemical Warfare	CFY	$ 13,159,000			
	PY	$ 572,000			
			In-House	$	1,945,000
	$ 13,731,000		Contract	$	11,786,000
TOTAL: **Advanced Development**	CFY	$ 36,457,000			
	PY	$ 1,924,000			
			In-House	$	9,363,000
	$ 38,381,000		Contract	$	29,018,000

c.	Full-scale Development				
	(1) Decontamination Concepts and Materiel		$ -0-		
	(2) Collective Protective Systems	CFY	$ 4,672,000		
		PY	$ 304,000		
				In-House	$ 940,000
			$ 4,976,000	Contract	$ 4,036,000
	(3) Warning and Detection Equipment	CFY	$ 10,613,000		
		PY	$ 77,000		
				In-House	$ 77,000
			$ 10,690,000	Contract	$ 10,613,000
	(4) Individual Protection Equipment	CFY	$ 6,139,000		
		PY	$ 287,000		
				In-House	$ 675,000
			$ 6,426,000	Contract	$ 5,751,000
	(5) Medical Chemical Defense Life Support Materiel	CFY	$ 5,611,000		
		PY	$ 980,000		
				In-House	$ 705,000
			$ 6,591,000	Contract	$ 5,886,000
d.	Testing		$ -0-		
TOTAL:	Full-scale Development	CFY	$ 27,035,000		
		PY	$ 1,648,000		
				In-House	$ 2,397,000
			$ 28,683,000	Contract	$ 26,286,000

TOTAL: CHEMICAL DEFENSIVE EQUIPMENT PROGRAM	CFY	$ 102,315,000		
	PY	$ 6,805,000		
		$ 109,120,000	In-House	$ 38,469,000
			Contract	$ 70,651,000
5. TRAINING SUPPORT		$ -0-		
6. SIMULANT TEST SUPPORT	CFY	$ 2,025,000		
	PY	$ -0-		
		$ 2,025,000	In-House	$ 914,000
			Contract	$ 1,111,000
7. MANAGEMENT AND SUPPORT	CFY	$ 11,237,000		
	PY	$ 1,309,000		
TOTAL: MANAGEMENT AND SUPPORT		$ 12,546,000	In-House	$ 10,735,000
			Contract	$ 1,811,000

SECTION I

OBLIGATION REPORT ON CHEMICAL WARFARE AND CHEMICAL DEFENSE PROGRAM

FOR THE PERIOD 1 OCTOBER 1988 THROUGH 30 SEPTEMBER 1989

DEPARTMENT OF THE ARMY

RCS: DD-USDRE (A) 1065

EXPLANATION OF OBLIGATION

1. CHEMICAL RESEARCH

a. Basic Research in Life Sciences

(1) Chemical Defense and Chemical Retaliatory Research. Program Element (PE) 61102, Project A71A

This program includes new concepts and the elucidation of mechanisms of decontamination and contamination avoidance; individual and collective protection; reconnaissance, identification, and detection; materials research; simulants; training systems; retaliatory chemical munitions; and properties of chemical threat agents.

During FY 89:

Achieved purification of halophilic organophosphorus anhydrases which will be applied to the enzymatic decontamination of chemical agents.

Established a collaborative research effort with the Department of Energy to detect compounds at low concentration levels and to study the behavior of single particles produced in aerosols.

Developed an improved mathematical model for predicting adsorption properties of weakly sorbed vapors on standard ASC charcoal.

Established a fundamental aerodynamics stability database for homogeneous, Newtonian, liquid-filled projectiles.

Developed a unique computerized system for studying rabbit sperm motility behavior as an alternative to animal toxicity testing.

Built a reactor to test and quantify the effectiveness of experimental catalyst in decontamination of mustard simulants under environmental testing conditions.

(2) **Clothing, Shelters and Other Material Systems. PE 61102, Project AH52**

The goal of this program is to establish potential technologies for the development of clothing and other protective material systems that will minimize the effects of chemical/biological (CB) agents and heat stress associated with wearing the protective ensemble.

During FY 89:

Initiated a theoretical study on the anomalous behavior of new fabrics.

Continued refinement of a model to estimate hydrostatic pressure resistance (HPR) in military fabrics. Continued studies relating surface free energy to HPR.

Completed a five-year Biotechnology Strategy Plan for the development and utilization of novel systems in chemical/biological protection and other protection areas.

Characterized a series of polymers, synthesized by oxidative enzymes in organic solvents, for chemical agent degradation.

Completed a five-year Reactive Polymers Long Range Plan for the development and utilization of reactive polymers for multi-agent protection.

Investigated methods for increasing the stability of copper complex systems which are very effective catalysts for detoxifying agents.

Evaluated and selected software for molecular modeling of chemical agent catalysts.

(3) **Medical Chemical Defense Research Program. PE 61102, Project BS11**

This program provides basic research by the United States (U.S.) Army to meet Joint Service and Service unique requirements for maximizing survivability and operational effectiveness of troops on the integrated battlefield. Emphasis is directed toward development of new technologies and unique methodologies required to determine and evaluate biomedical effects resulting from current and potential chemical warfare agents and therapies. Accomplishments emerging from this effort will

serve as the basis for further development of new protective and therapeutic systems against exposure to current and novel chemical warfare (CW) agents and provide tools necessary for determining mechanisms of action.

During FY 89:

Established several reliable new metabolic and biochemical markers for pulmonary injury and examined ultrastructural changes as markers for acute and chronic exposure to pulmonary and vesicant agents.

Evaluated the feasibility of catalytic antibody pretreatment approach to protection from chemical warfare nerve agent toxicity.

Validated methods for detecting nerve transmitters at the neuromuscular junction.

Demonstrated protection against multiple lethal doses of nerve agent using scavenger molecules or monoclonal antibodies.

b. General Chemical Investigations: Exploratory Development. PE 62622, Project A553

(1) **Chemical Biological (CB) Threat Agent Chemistry and Effects.**

The objectives are to identify, synthesize and study the chemical, physical, toxicological properties of chemical/biological materials and to maintain a modern technology base in the requisite disciplines in order to assess the potential threat of these materials to the U.S. CB defense posture; to analyze foreign intelligence and other potentially hazardous samples for the presence of CB agents and related materials and to advance the scientific expertise, instrumentation, and methodology to do this by the most up-to-date techniques; and to provide a current assessment of the status of CB threat agents to the Department of Defense (DOD) CB defense community.

During FY 89:

Received accreditation from the American Association of Laboratory Animal Care for the toxicology program which supports the CB Threat Chemistry and Effects program.

Published a revised, updated report of the International Task Force Six on Tripartite Agent Assessment. This report presents rationale and references for the assessment of CB threat agents and is used to guide CB defense materials research and development programs in the United States, United Kingdom and Canada.

Developed several new analytical methods for conducting chemical analyses of various threat agents and other hazardous materials. These methodologies have immediate application for threat agent and environmental sample analyses and potential application for treaty verification.

Developed a computerized data base of over 350 naturally occurring toxic materials that have potential as CB threat agents.

Completed a collaborative toxicology study on the assessment of lung damage caused by a class of highly toxic irritants of concern as threat agents.

(2) **Analysis and Integration of Chemical Defense Systems**

The objectives of this program are to develop a cohesive system of analytical models and the supporting data bases to assess the challenges posed by the foreign chemical and biological threat and to evaluate chemical and biological defense systems against the threat; to develop new models to estimate the effects of chemical warfare agents on the battlefield and to use these models for the assessment of alternative concepts and designs; and to provide other Department of Defense (DOD) chemical analysts and wargamers with mathematical models and methodology for their analyses.

During FY 89:

Developed an enhanced version of the single round, chemical munition model which addresses multi-component agent mixtures which evaporate at differing rates.

Initiated development of a general purpose model to address the dissemination, transport, and diffusion of liquid chemical agents delivered by both red and blue munition systems.

Established a data base for validating transport diffusion models.

Completed wargame simulations in support of the Integrated Chemical and Biological Defense Front End Analysis to assess the operational payoffs to the Army by the introduction of new chemical defense materiel.

Developed an Integrated Threat Assessment Plan to address the challenge imposed by chemical and biological threat.

(3) **Chemical Biological (CB) Simulants, Survivability and Systems Science**

The objectives of this program are to establish a DOD and International Center for information and data on simulants for chemical and biological agents; to provide Nuclear, Biological and Chemical (NBC) contamination survivability technology base data and to evaluate methodology for the assessment of equipment survivability and effects of agent and decontamination material; to identify and provide generic CB defense data and operational science data common to functional development areas; and to acquire and develop special test technologies.

During FY 89:

Held the third International Simulant Workshop in March of FY 89.

Renewed a memorandum of understanding for collaborative studies of chemical operations under cold conditions.

Completed an in-depth special analysis of microencapsulation technology and established a multi-agency working group.

Assessed the aercsol hazards to individual soldiers on the battlefield for the Dusty Agent Action Working Group.

Verified that the Chemical Agent Monitor's vapor detection system can detect dusty agent aerosol simulants.

Evaluated contamination transfer caused by personal exit/entry of the M60 tank and transitioned the results for modeling applications.

Developed standardized sorption/desorption tests for agents and initiated these tests on a variety of military-specific materials.

2. **LETHAL CHEMICAL PROGRAM**

a. **Exploratory Development. PE 62622, Project A554**

The objectives of this program are to develop chemical agent/munition systems to provide a dependable and credible deterrent and a safe and modern retaliatory capability; and to maintain advanced technology in chemical agent weaponry to avoid any technological lag or surprise.

During FY 89:

Developed a binary process for weaponization of a unique chemical compound.

Initiated studies to assess sublethal effects of a unique chemical compound.

b. **Advanced Development**

No obligations were incurred.

c. **Full-scale Development**

Multiple Launch Rocket System (MLRS) Binary Chemical Warhead (BCW): XM135 PE 64803, Project DP95

The objective is to develop a free flight chemical agent dispersing system which will be employed by the MLRS batteries and battalions in the same manner as the MLRS conventional warhead. The BCW will produce a semi-persistent agent which when dispersed will cause immediate casualties on enemy troops and cause them to mask, don protective gear, or restrict themselves to protective structures. This agent will remain effective in the target area for several hours before decomposing. As a system, the MLRS will require only minor modifications to support the requirements of the BCW.

During FY 89:

Initiated equipment acquisition and installation phase for the injector assembly pre-production scale fill/close process line.

Completed engineering evaluation testing of the XM450 Medium Altitude Proximity/Time Fuse.

Initiated dissemination and scored performance flight testing programs.

Continued software development to integrate the BCW into the MLRS configuration.

d. **Testing**

No obligations were incurred.

3. **INCAPACITATING CHEMICAL PROGRAM**

a. **Exploratory Development. PE 62622, Project A554**

The objectives of this program are to discover new quick acting physically incapacitating compounds which are effective by inhalation and absorption through the skin; and to synthesize and evaluate potent analgesics and volatile anesthetics.

During FY 89:

Awarded a contract for estimating the cost of production quantities of the candidate incapacitating chemicals.

Completed intermediate toxicity studies of the candidate opiod with an additional animal species.

Initiated studies with an opiod-adjuvant mixture for enhanced safety.

Developed a decontaminant for the candidate incapacitant.

b. **Advanced Development** No obligations were incurred.

c. **Full-scale Development** No obligations were incurred.

d. **Testing** No obligations were incurred.

4. CHEMICAL DEFENSIVE EQUIPMENT PROGRAM

a. Exploratory Development

(1) Physical Protection Investigations

Chemical and Biological Decontamination and Contamination Avoidance. PE 62622, Project A553 and PE 62786, Projects AH20 and D283

The objectives of this program are to investigate procedures, designs, and materials to enhance survivability of troops in a chemical, biological, and radiological environment; to develop equipment to decontaminate personnel, personal items, and military equipment; to improve the efficiency of the decontamination process; and to develop methods of avoiding or minimizing contamination.

During FY 89:

Continued development of a microemulsion formulation for deliberate decontamination operations. Selected a final formulation and successfully tested it against four chemical agents.

Developed four packaging options for consideration in the development of the continuous mixer for preparing the microemulsion decontaminant. Prepared for transition of the formula to full-scale development in FY 90.

Initiated a program to develop catalytic oxidants suitable for incorporation into the microemulsion decontaminant as part of a preplanned product improvement effort to replace the logistically unattractive hypochlorite oxidant.

Prepared and evaluated a new self-stripping coating formulation which showed promising results.

Determined that the NBC Protective Cover will protect airdrop equipment and rigged airdrop loads from becoming contaminated.

Continued studies to develop a non-isocyanate Chemical Agent Resistant Coating (CARC) and continued testing CARC to ensure compliance with all Environmental Protection Agency requirements.

Individual Protection. PE 62622, Project A553 and PE 62786, Project AH98

The objectives are to evolve concepts for individual protection against potential threat agents for Joint Service application; to develop a technical base to study the mechanism of chemical biological protective materials; and to maintain a center of excellence in respiratory protection.

During FY 89:

Designed alternate sizes for the prototype Aircrew Protective Mask System.

Convened a technology workshop to identify new technology areas relevant to the Respiratory Protection System 21 (RESPO 21) technology and future respiratory protective systems design.

Completed RESPO 21 surveys to identify applicable technologies and sources of those technologies.

Developed a computerized mathematical model which simulates human body functions.

Purchased and installed a 3-D anthropometric scanner system. Conducted head scans of test subjects and began developing algorithms to fuse all images into a common facial anthropometry system.

Completed initial baseline pulmonary function testing using the M40 CB Protective Mask.

Fabricated twenty prototype two-piece hoods for the M40 mask for future human factors and protection factor testing.

Prepared a draft purchase description and pattern drawings for the M40 Pre-planned Product Improvement Program (P3I) hood design.

Defined baseline for vision, speech, and acoustic characteristics of current inventory respirators.

Developed a telemetry system for transmitting data for the Mask Fit Validation Device.

Completed the first phase of a vapor/aerosol correlations study to determine whether corn oil can be used as an acceptable vapor surrogate. This study supports challenge testing of protective ensembles.

Conducted biochemical comparisons between different bacterial enzymes and a protozoan enzyme capable of degrading nerve agents.

Developed effective blends of a metal coordinated biopolymer with nylon which showed enhanced catalytic reactivity at low humidity levels.

Analyzed test results of different combinations of standard and advanced chemical protective ensembles and compared the effects of a variety of human performance measures.

Conducted a laboratory evaluation of contractor delivered developmental personal hygiene and waste management kits for compatibility with the advanced chemical protective ensemble concept.

Developed an automated static vapor test using a dual robotic system for safe and accurate testing of reactive materials against chemical agent surrogates.

Developed a safe and accurate test method, using chemical simulants, that facilitates rapid screening of chemical agent reactive materials.

Devised a test program for testing solid aerosols (dusty agent) against clothing and fabrics.

Determined that a chemical protective clothing system, based on an undergarment concept, provides soldiers some relief from heat stress and associated performance degradation.

Prepared improved elastomeric material samples for a flame-resistant tactile glove and evaluated their physical performance properties and chemical resistance.

Developed and tested an improved method for evaluating the chemical agent resistance of impermeable materials.

Conducted an analysis of next generation/future clothing and individual equipment to identify performance requirements as well as technical barriers.

Selected and obtained sample fabrics for evaluating chemical and biological aerosol resistant properties.

Collective Protection. PE 62622, Project A553

The objectives of this program are to evolve concepts for collective protection against present and future threat agents for Joint Service application; and to develop and maintain a technical base on the mechanisms of protection against chemical and biological agents.

During FY 89:

Continued development of a pressure swing adsorption prototype for a filtration test bed.

Continued a development plan to eliminate the use of chromium, a hazardous material, from the current military adsorbent, ASC carbon. Developed a manufacturing process and demonstrated the producibility of the new carbon formulation (developed in FY 88) on a pilot plant scale. Improved drying technology to reduce the ammonia off-gassing of this new carbon as compared to that of the current ASC carbon.

Continued development of the Reactive Bed Plasma technology for destruction of chemical and biological agents. Conducted studies of potential post treatment methods of by-products removal. Completed development of a 30 cubic feet per minute prototype reactor leading to a new collective protection system.

Continued to quantify the performance of adsorbents against potential new threat agents at various environmental conditions.

Continued an accelerated development program of a new reactive sorbent for NBC filter systems to provide broader protection capability than that provided by ASC carbon. Identified an additional impregnant which expands the protection of the new sorbent.

Conducted investigations to identify the sorption mechanisms of nonstandard agents.

Conducted a two-week field test of two Battalion Aid Station medical shelters in an area contaminated with chemical simulants to determine the effectiveness of procedures and equipment for litter-patient processing.

(2) Warning and Detection Investigations. PE 62622, Project A553

Reconnaissance, Detection, and Identification

The objectives of this program are to evolve new and improved concepts, methods, and materials for point detection, identification and warning for all chemical and biological agents for Joint Service applications; to develop concepts for product improvement programs to upgrade standard chemical and biological agent point detectors; and to update and maintain a Reconnaissance, Detection, and Identification (RDI) Master Plan.

During FY 89:

CB Mass Spectrometer (CBMS) Technology:

Completed phase I (proof of concept) and initiated phase II (fabrication of concept models) of the CBMS exploratory development contract.

Drafted an Operational and Organizational Plan.

Developed an unclassified mass spectral data base of potential biological and chemical threat agents as well as potential battlefield interferences.

Established a test matrix for the CBMS.

Stand-off Detection Technology:

Developed specifications and prepared a scope of work for a lightweight frequency agile laser that will provide rapid area detection for the NBC Reconnaissance Vehicle program.

Developed a combined vapor-aerosol algorithm for the laser chemical stand-off detector.

Evaluated a fast scan interferometer and developed design specifications for the Unmanned Aerial Vehicle and the Helicopter Vapor Stand-off Detector.

Built and tested a breadboard of a digital signal processor for real time stand-off detector pattern recognition.

Initiated a technical interchange agreement with academia on thermal imaging.

Developed unique spatial frequency detection techniques for forward looking infrared imagery.

Bio-Chemical (BC) Detector Technology:

Initiated a collaborative development program for the BC Detector with the United Kingdom and Canada.

Conducted a breadboard design review and established a design concept.

(3) Medical Defense Against Chemical Agents. PE 62787, Project A875

This program supports the Joint Service and Service unique exploratory development for medical chemical defense. It emphasizes the prevention of casualties through application of drugs or chemical compounds for prevention or treatment of the toxic processes of conventional and novel CW agents. A majority of the resources supports development of prophylactic/pretreatment compounds, antidotes, skin decontaminants, and therapeutic agents that will counteract the lethal, physical, and behavioral decrements of CW agents. The remainder of the resources supports development of medical materiel that insures adequate patient care, field resuscitation, and patient management procedures.

During FY 89:

Continued using a computer-assisted drug modeling capability for conducting directed synthesis of drugs to potentially improve medical countermeasures to chemical warfare agents.

Continued to develop decision tree networks for the rapid selection of candidate antidotes, pretreatments, and topical protectants against chemical warfare threat agents.

Continued the active screening of compounds for efficacy against chemical warfare threat agents.

Evaluated aviator performance following administration of a chemical warfare threat agent antidote.

Developed a capability to monitor chemical agent presence in environmental air samples and in environmental liquid samples.

Tested five candidate topical protectants for efficacy against nerve and blister chemical warfare agents.

b. Advanced Development

(1) Chemical Decontaminating Materiel

Non-aqueous Equipment Decontamination System (NAEDS): PE 63806, Project DE81

This system is being developed to decontaminate small items of equipment, avionics, communication, electronic and optical equipment, personal equipment, and weapons. Two versions will be fielded: an interim item for use at fixed sites only and a mobile, fully militarized item which will be trailer mounted for use anywhere on the battlefield.

During FY 89:

Completed fabrication and preliminary functional testing of an engineering test prototype.

Finalized requirements for the fixed site system.

Initiated development of mobile concepts that can be effectively employed on the battlefield.

Continued work on the development of the Technical Data Package, identified specific fixed site system users, and began formulating fielding concepts.

Continued coordination with the Laundry and Decontamination Dry Cleaning System development program.

Modular Decontamination System (MDS): PE 63806, Project DE81

This system is designed to fill the washing, decontaminant application, and rinsing requirements of a vehicle decontamination line. The system will provide hot water and high pressure water for cleaning and rinsing vehicles and will provide a capability to dispense standard chemical decontaminants and new decontaminating emulsions. The system will provide higher mobility, flexibility, and reliability than currently fielded decontamination systems.

During FY 89:

Prepared a System Manpower and Personnel Integration Management plan and integrated this plan with the draft Required Operational Capability (ROC).

Obtained approvals of the Acquisition Strategy and Plan, Baseline Cost Estimate, and the Test and Evaluation Master Plan.

Completed initial design efforts for two of the system modules.

Prepared the contract statement of work for the development and incorporated an option for initial production of two MDS modules.

Individual Equipment Decontamination (IED): PE 63806, Project DE81

The IED kit wil be used to decontaminate a soldier's individual equipment, which includes the chemical/biological protective mask/hood, gloves, footwear, weapon, helmet, and load bearing equipment. The IED kit will reduce soldier agent exposure, will minimize the agent penetration into surfaces of individual equipment, and will minimize agent transfer during battle dress overgarment exchange and entry-exit procedures. The IED kit's active ingredient will consist of either a chlorinate

solvent mixture or a dry, reactive, resin powder. The two decontamination technologies are being competed to determine the most advantageous decontaminant.

During FY 89:

Developed a three phase agent testing program to compare the chlorine based decontaminant with the reactive resin decontaminant and completed the first phase.

Completed a resin rifle malfunction study which investigated the possibility of weapon performance degradation.

Prepared a task to investigate human engineering designs for the resin based system and to investigate state-of-the-art packaging for the chlorine based liquid decontaminant.

Laundry and Dry Cleaning Decontamination System (LADDS): PE 63747, Project D669

This system is being developed to perform non-aqueous dry cleaning and decontamination of clothing and individual equipment items exposed to vegetable stains, dirt, sweat, petroleum products and to NBC contamination. The proposed system will eliminate the present dependency for water, reduce the resource requirements of current systems, and increase the rate at which chemical agents are decontaminated.

During FY 89:

Redesigned a prototype to reduce weight and noise signature.

Received two second generation LADDS prototypes from the development contractor.

Validated operational and maintenance manuals for the LADDS.

(2) Collective Protection Concepts

Standard Integrated Command Post System (SICPS): PE 63804, Project D428

The SICPS will integrate chemical and electromagnetic protection into a shelter system to fit on the High Mobility Multi-Purpose Wheeled Vehicle and the Commercial Utility Cargo Vehicle. The shelter will be integrated with power, air conditioning,

ventilation, lights, and racks to support the communications and electronics equipment utilized for command, control, and communications and intelligence (C3I) missions.

During FY 89:

Redesigned the SICPS using the best characteristics of four concept shelters.

Contracted and fabricated prototype shelters for technical testing and user evaluation.

Revised test requirements to include systems testing with surrogate and existing systems equipment.

Chemically and Biologically Protected Shelter (CBPS): (formerly known as the Chemical-Biological Hardened Shelter System) **PE 63804, Project D428**

The CBPS will be a highly mobile system providing a contamination-free environmentally-controlled working area for a Battalion Aid Station, moving up to three times a day, or a Division Clearing Station (two systems joined together) moving once every three days. The system will be easy to erect, have increased floor space, improved air lock operation, natural ventilation capability, and be issued with a prime mover.

During FY 89:

Reactivated the task when funding was received in May 89.

Initiated hot and cold testing in an Air Force climatic chamber.

Initiated efforts to CB harden the air conditioning unit.

Initiated the redesign of the shelter to incorporate improvements derived from testing.

NBC Contamination Survivability: PE 63806, Project DJ30

The objectives are to provide technical support and guidance to materiel

developers in implementing both DOD Instruction 4245.13, Design and Acquisition of Nuclear, Biological and Chemical (NBC) Contamination-Survivability Systems and AR 70-71, NBC Contamination Survivability of Army Materiel; to conduct general studies on NBC vulnerability/survivability; and to identify technical base studies to fulfill knowledge gaps and enable systems and personnel survival in the NBC environment.

During FY 89:

Continued a study to analyze and assess the NBC survivability of both existing and developmental military equipment.

Continued to provide data to program/project managers within U.S. Army Materiel Command on the characteristics of AR 70-71, the interaction of chemical agents and decontaminants on materiel, and on techniques to mitigate degradative interactions to foster survivability.

Continued to provide technical assistance to program/project managers in development of statements of work, requests for proposal, and system specifications. Assisted in several source selection processes for major systems, including the Advanced Anti-Tank Weapons System - Medium.

Provided technical agent testing support for the High Mobility Multi-Wheeled Vehicle (HMMWV), M1A1 Abrams Tank, and the Forest Products Laboratory wood pallet initiative.

Published several managerial documents and Military Handbook 784, "Guidelines-Design to Minimize Contamination and to Facilitate Decontamination of Military Vehicles and Other Equipment: Interiors and Exteriors."

(3) **Individual Protection Concepts**

Ground/Air Microclimate Cooling System: PE 63747, Project D669

This program will provide auxiliary cooling equipment for dissipating metabolic heat while performing operational tasks on and off vehicles/aircraft in hot dry/wet environments. Cooling will be accomplished by circulating chilled liquid or chemical/biologically filtered conditioned air (supplied by the vehicle cooling unit or individually worn backpack) through a garment.

During FY 89:

Awarded a contract for an improved hermetic compressor, containing an alternator and water pump, to reduce the number of components in the microclimate cooling backpack.

Developed and tested a migrating combustion chamber engine as the power source to the microclimate cooling backpack.

Evaluated an improved ambient air microclimate cooling backpack.

Nuclear, Biological and Chemical - Protective Covers (NBC-PC): PE 63747, Project D669

The NBC-PC will provide a lightweight, disposable barrier to protect supplies and equipment from liquid chemical/biological attack and ambient temperature radiological fallout. This design will ease the burden of decontamination throughout the Army providing a barrier between the contaminants and the supplies/equipment.

During FY 89:

Completed development. Adoption as an expendable item is expected in FY 90.

Multipurpose Overboot (MULO): PE 63747, Project D669

The MULO is to replace the current chemical protective footwear cover and the wet weather overshoe by combining the salient characteristics of each boot into a single item. Flame resistance, decontaminability, and resistance to petroleum, oils, and lubricants are to be considered in designing the MULO.

During FY 89:

Selected the Green Vinyl Overshoe as the interim replacement to the Chemical Protective Footwear Cover until the MULO development is successfully completed.

Completed testing two material blends and two boot designs.

Reviewed results during a Test Integration Working Group meeting and determined that the materials did not provide the required durability.

Recommended continuing exploratory development for a durable and chemical resistant material for the MULO.

Self-contained Toxic Environment Protective Outfit - Interim: (STEPO-I) PE 63747, Project D669

The STEPO-I will provide two hours of protection for depot workers in immediately dangerous to life and health environments. Current off-the-shelf technologies will be utilized to expedite this effort.

During FY 89:

Received and evaluated test quantities of equipment items during the Technical Test/User Test phase.

Prepared a statement of work for an Army procurement contract for system component integration and fielding.

Self-contained Toxic Environment Protective Outfit (STEPO): PE 63747, Project D669

STEPO will provide four hours of protection against chemical/biological agents, industrial chemicals, petroleums, oils, and lubricant (POL) products and radioactive particles for use by explosive ordnance disposal and depot workers. The suit will be integrated with a non-filtered four hour breathing system and microclimate cooling equipment.

During FY 89:

Awarded a contract for the STEPO design, component integration, and fabrication of initial prototype for testing.

Received initial prototypes and initiated physiological and human factors testing.

(4) Chemical Detection and Warning Materiel

Automatic Liquid Agent Detector (ALAD): XM86 PE 63759, Project DE83 (Unfunded)

The ALAD is an automatic liquid chemical agent detector unit that detects a single drop of threat material such as thickened nerve and blister agent. The detection mechanism is based on the physical chemical interaction of the agent with a special paint resin in which there are very fine elemental silver flakes suspended. This silver-bearing paint acts as an electrical conductor, which swells when attacked by an agent, causing physical separation of the conductive silver flakes and a resulting change in the electrical resistance of the detector grid. This change activates an alarm function. The major components are the detector unit and the insertable sensor element.

The ALAD program was officially made two separate programs, one to address the liquid agent threat (ALAD) and one to address the development of a dedicated chemical warning communication line Chemical Agent Detector Network (CADNET). The ALAD is intended for use in Combat Support, Combat Service Support, and Fixed Site mission profiles.

The objective of this program is to complete development, and test and evaluation of an ALAD under a joint program with the U.S. Air Force (USAF). The ALAD will be designed and fabricated to meet the requirements of both Services. The USAF is the lead Service for the joint USAF-Army program.

During FY 89:

Terminated Army participation in the Joint Service development of the ALAD in Jan 88 due to lack of funds and the low priority of need for the item.

Retained Army option to buy ALAD in the USAF contract. The Army may exercise this option, should funding be restored.

Published a summary technical report on the Army ALAD program that was prepared in FY 88.

Chemical Agent Detector Network (CADNET): XM23/XM24 PE 63759, Project D883

The objective of this project is to provide a rapid warning and reporting system for nuclear, biological and chemical (NBC) detectors and disseminate critical NBC information on the battlefield. The CADNET rapidly alerts infantry and vehicle mounted battlefield units to an alarm from a nuclear, biological, or chemical (NBC) detector. The CADNET passes the NBC alarm from fielded NBC detectors to the Command and Control (C2) radios on the battlefield. The alarm originates at the NBC detector and is transmitted via the XM23 (detector/transmitter interface) back to the XM24 (receiver audio interface) via radio frequency or field wire for retransmission over the C2 radio system. An M42 Alarm Unit immediately alerts all unit personnel to don mission oriented protective posture (MOPP) gear, and an audible alarm is produced on the C2 radio in the background of voice communication.

During FY 89:

Conducted a Required Operational Capability Joint Working Group meeting at the U.S. Army Chemical School.

Submitted a Reliability, Availability and Maintainability Rationale for user approval.

Conducted a Program Status Review in Mar 89 for the Army community.

Prepared a new equipment training task to provide training to initial key personnel in support of Technical Test/User Test.

Awarded a contract to fabricate a cast case to house the electronics for the XM24 interface module.

Updated the approved Acquisition Strategy to accurately delineate the current program.

Automatic Chemical Agent Alarm (ACADA): XM22 PE 63806, Project D601

The objective of this task is to develop an advanced point-sampling, chemical agent alarm system for multi-purpose use as an automatic alarm to provide area warning, a survey instrument to detect contaminated surfaces, and a monitor inside

collective protection shelters. The XM22 ACADA will detect and identify all standard nerve and blister agents and will be reprogrammable to incorporate new threat agents.

During FY 89:

Completed fabrication of five ACADA brassboard units for use in development testing.

Improved the ACADA's detection capability by modifying the algorithm based on agent and interference testing.

Conducted development testing of ACADA brassboards to establish a technical performance baseline.

Completed engineering drawings and specifications to document current design.

Prepared an acquisition plan and a statement of work for a full-scale development contract.

Completed preparation for a Milestone II In-Process Review to transition the ACADA into the full-scale development phase.

Joint Fixed Site NBC Defense: (formerly known as the Fixed Site Chemical Detection and Warning System (FSCDWS)) **PE 63759, Project DE83**

As a result of fixed site surveys and lack of field support from the user, the FSCDWS was restructured into the Joint Fixed Site NBC Defense project. The objectives of this project are to provide a technical report that outlines key parameters that must be considered by fixed site personnel responsible for NBC hardening a facility or installation. Guidelines for implementation of collective protection equipment, detection systems, decontamination equipment, and NBC survivability procedures will be included in the document. Surveys of several fixed installations in the Far East will be conducted to assist the Eighth U.S. Army in initiating an NBC hardening program.

During FY 89:

Provided a list of fixed site components of collective protection, detection, and decontamination to the 8th U.S. Army that could be used for fixed site defense.

Conducted four Far East fixed sites surveys. Provided concepts and projected cost estimates for NBC hardening of the sites to the 8th U.S. Army and the Far East District Corps of Engineers.

Prepared a draft report which provides general technical guidance for converting existing buildings into NBC hardened Army fixed sites.

Completed the data transfer required for field commanders to implement fixed site NBC defense through normal construction project channels.

Treaty Verification: PE 63759, Project DE83

The objective of this project is to establish a Treaty Verification Office responsible for answering chemical weapons and arms control taskers, preparing briefings, and developing future program plans for ensuring treaty compliance.

During FY 89:

Initiated a program to consider applications of current technology toward chemical treaty verification.

Completed a Chemical Weapons Technology Review and briefed the Chief of Staff of the Army.

(5) <u>Medical Chemical Defense Life Support Materiel. PE 63002, Project D995</u>

Nonsystem:

The purpose of this program is to support the Department of Defense nonsystem advanced development for medical chemical defense. It utilizes technology and further screens candidate compounds. Analytical and stability studies are performed on advanced candidate compounds. It also supports development of "breadboard" materiel models.

During FY 89:

Continued the evaluation of cyanide pretreatment compounds.

Continued scaled-up synthesis of candidate anti-chemical warfare drugs under Food and Drug Administration Good Manufacturing Practices regulations to support the drug development mission.

Continued validation of performance assessment methodology for predicting performance decrements caused by pretreatment and antidote drugs.

Initiated an improved nerve agent antidote project.

Determined the effects of nerve agent pretreatment on operational performance and physiology of A-10 Thunderbolt pilots.

(6) **Medical Defense Against Chemical Warfare. PE 63751, Project D993**

The objective of this program is to achieve a modern and viable capability for fielding medical defense against CW agents to meet the Joint Service Requirements. The advanced development includes specific prophylactic/pretreatment, antidotal and therapeutic drugs as well as skin decontaminants and specialized medical materiel for diagnosis and management of both chemical and chemical/conventional casualties, which will provide the soldier maximum protection and survivability on the integrated battlefield. This project provides for hardening of conventional medical equipment in a chemical environment and determination of soldier performance decrements and limits. It supports advanced drug development efforts on formulation stability, final dosage studies, and limited safety studies and preclinical toxicity studies.

During FY 89:

Evaluated several formulations of a sustained release pyridostigmine to be used as a pretreatment for nerve agent poisoning.

Conducted a Milestone I/II In-Process Review for an anticonvulsant therapy for nerve agent poisoning. This project was transitioned to full-scale development and a contract was awarded for this phase of development.

Conducted the final required clinical study on an aerosolized antidote for nerve agent poisoning prior to seeking Food and Drug Administration approval.

Conducted technical tests of two life detector prototypes in a high noise and vibration environment.

Held a Concept Evaluation Program Review and conducted technical tests of commercial and developmental prototypes of vital signs monitors.

Successfully demonstrated technical feasibility of modified prototypes of powered ventilatory assistance devices.

Initiated fabrication of prototype mounting systems for the Ballistic-Laser Protective Spectacles prescription lens carrier in the M-40 CB Protective Mask.

c. Full-scale Development

(1) Decontamination Concepts and Materiel

No obligations were incurred.

(2) Collective Protection Systems

Modular Collective Protection Equipment (MCPE): PE 64806, Project D017 (FY 88 Carry-over)

The modular collective protection equipment consists of a family of end items: three different sized filter units, four protective entrances and a static frequency converter. The MCPE will provide nuclear, biological, and chemical protection by providing filtered air under positive pressure to vans, vehicles, and shelters to prevent the infiltration of toxic chemicals, biological agents, and radioactive particles. A collapsible protective entrance which is pressurized in the same manner provides entry/exit capabilities for these vans, vehicles, and shelters. Pressurization is provided by the filter units and is automatically maintained. Generally, the basic units are installed outside the protected area while the controls are located inside.

During FY 89:

Completed all development II testing of the MCPE system and components, and corrected all design deficiencies.

Held a Special In-Process Review.

Completed the successful development program and prepared the MCPE for adoption by candidate host systems.

Provided design application support to several combat, command, communication and control systems for integration and testing of the MCPE.

Simplified Collective Protection Equipment (SCPE) M20: Pre-planned Product Improvement (P3I) PE 64806, Project D017

The SCPE P3I program will expand the capability of the current system (Collective Protection Equipment: NBC, Simplified, M20) by incorporating improvements specified in the M20 Letter Requirement. Requirements to be satisfied are: a liquid chemical agent resistant liner material; a medical airlock for litter patients; an increased entry/exit rate; an interface with existing environmental control units, and an interface to the Tent, Extendable, Modular Personnel.

During FY 89:

Completed engineering design testing and reliability qualification testing of prototype hardware.

Completed preparation of the Technical Data Package.

Chemical/Biological Hardened Rigid Wall Shelter (Nonexpandable): PE 64804, Project D429

The Chemical/Biological Hardened Rigid Wall Shelter (Nonexpandable) will provide the capability to protect sophisticated communications and computer systems from electromagnetic interference and provide a shirt-sleeve environment for equipment operators during chemical/biological warfare utilizing modular collective protection equipment.

During FY 89:

Completed development of the CB Hardened Nonexpandable Rigid Wall Shelter and adoption is expected in FY 90.

Continued development of an electromagnetic interference protection capability.

Chemical/Biological Hardened Expandable Rigid Wall Shelter: PE 64804, Project D429

The Chemical/Biological Hardened Rigid Wall Shelter will provide chemical and biological protection for the one-side expandable and two-side expandable tactical shelters and the personnel and equipment operating inside the shelter.

During FY 89:

Completed fabrication of the one-side and two-side expandable shelters.

Revised design and retrofitted the two-side expandable shelter with new CB resistant gaskets.

Tested shelters and discovered excessive carbon monoxide and hydrogen cyanide emissions from the environmental control units. Initiated corrective actions.

(3) Warning and Detection Equipment

Reconnaissance System, Nuclear-Biological-Chemical (NBCRS): XM93 (formerly known as NBCRS, XM87) **PE 64806, Project D020**

The objective is to develop a system to fill an urgent operational need which integrates a variety of sensors/detectors and auxiliary subsystems into a host vehicle dedicated to conducting nuclear, biological, and chemical (NBC) reconnaissance. This system will collect and report NBC contamination faster and more accurately than is currently possible. The NBCRS will be composed of chemical and nuclear detectors, a navigation system, a central data processor, digital communication devices, a life support system which provides vehicle overpressure and heating and cooling for the crew members, a mechanized sampling and collection system, a marking system, and a meteorological system. The program will be conducted as a Nondevelopment Item (NDI), using contractor provided systems for an evaluation, and

selection of a single NDI system for follow-on improvement and production. The NBCRS development is receiving special Army emphasis through the application of intensive project management by the Project Manager NBC Defense Systems.

During FY 89:

Received and evaluated contract proposals from two corporations who had teamed to produce an NBCRS suitable for a competitive test.

Conducted a competitive test of candidate systems in accordance with Congressional directed NDI program strategy.

Remote Sensing Chemical Agent Alarm, (RSCAAL): XM21 PE 64806, Project D020

The Remote Sensing Chemical Agent Alarm, XM21, is an automatic scanning, passive, infrared sensor which detects both nerve and blister agent vapor clouds based on changes in the infrared signature of the background viewed (remote objects/terrain/sky) caused by the agent cloud(s). The XM21 will scan a 60-degree arc and is effective at line-of-sight distances of 2-3 miles. The XM21 system consists of a detector unit, tripod, transit case and power cable. The XM21 can be powered by standard military power sources. The Marine Corps and the Air Force plan to use the XM21 on its tripod for point or area surveillance missions. The Army plans to mount the XM21 on the NBC Reconnaissance System (NBCRS) for surveillance and reconnaissance missions. All integration with the NBCRS will be accomplished under the NBCRS System Improvement Program. The XM21 development is receiving special Army emphasis through the application of intensive project management by the Project Manager NBC Defense Systems due to its use with the NBC Reconnaissance System and fielding requirements from the other services.

During FY 89:

Completed environmental and electronics technical testing of prototype systems.

Initiated the remaining required technical tests and began preparing for a multi-service user test.

(4) Individual Protection Equipment

Coat and Trousers, Chemical Protective, Aircrew, Flame Resistant: PE 64713, Project DL40

The AUIB ensemble is designed to provide chemical and flame protection in one uniform; thereby, reducing both weight and bulk over the current system and providing increased man-machine interface capabilities. In addition, the AUIB ensemble is being designed to interface with microclimate conditioning equipment as well as aviation life support equipment.

During FY 89:

Conducted additional anthropometric studies evaluating possible reductions in the number of sizes for the system. Completed a final report offering two optional size chart improvements for the sizing system.

Received type classification approval from the Chief of Staff of the Army.

Suit, Contamination Avoidance and Liquid Protective (SCALP): PE 64713, Project DL40

The SCALP overgarment will be a lightweight, expendable, inexpensive suit which provides a barrier to water, liquid chemical agents, toxins, decontaminants and POL when worn over the chemical protective ensemble (CPE). The SCALP will prevent gross liquid agent contamination of CPE during short-term operations outside collectively protected systems.

During FY 89:

Performed final operational tests in cold regions and prepared a test report.

Finalized the Technical Data Package for procurement.

Presented the SCALP to the Type Classification Review Panel and received approval to present the item to the Clothing Advising Group.

Aircrew Chemical (CB) Protective Mask, M43: Pre-planned Product Improvement (P3I) PE 64801, Project DC45

The M43 CB Protective Mask was developed on a greatly accelerated schedule in order to meet the fielding dates of the AH-64 aircraft. Program management recognized that certain technical requirements could not be met within the compressed time period dictated by the fielding schedule. An Acquisition Strategy was selected which included a Pre-planned Product Improvement Program to address improved capabilities in nuclear survivability, chemical decontamination, corrective optics, and equipment integration. The Pre-planned Product Improvement Program is scheduled for a three year effort.

During FY 89:

Validated a computer aided design generated version of the Technical Data Package and fabricated M43B1 systems for Technical and User Test programs scheduled for FY 90.

Evaluated and confirmed the compatibility of the external, attached outsert vision correction spectacles with the night vision goggles.

Successfully completed initial human factors, protection factor, and nuclear thermal survivability evaluations of the mask system and auxiliary equipment.

Mask Drinking System (MDS): PE 64713, Project DL40

This program will develop a lightweight, expendable, pressurized hydration system to deliver liquids from the canteen to the soldier while wearing a protective mask with a drinking capability. The MDS will be compatible with existing standard issue items.

During FY 89:

Procured and received prototype nondevelopmental systems and conducted human factors testing.

Delayed chemical agent testing since the items were not designed and manufactured with chemical resistant materials.

Awarded a contract to redesign/modify the MDS for use in a chemical agent contaminated environment.

(5) **Medical Chemical Defense Life Support Materiel: PE 63002, Project D995**

The purpose of this program is to complete the technical data packages necessary for the fielding and logistical support requirements for medical equipment, supplies and drugs essential to counteracting the threat on the integrated battlefield. This effort will fund full-scale development of drugs and medical materiel through low-rate initial production. Additionally, foreign medical materiel may be acquired for exploitation of advanced technology and development to meet medical chemical defense goals.

During FY 89:

Completed contract delivery of optical correction inserts for the M-40 CB Protective Mask.

Initiated low-rate initial production of a decontaminable folding litter.

Concluded technical testing of the XM291 Skin Decontaminating Kit which will replace the M258A1 Personal Decontamination Kit and the M58A1 Training Aid. Obtained Food and Drug Administration approval of the XM291 as a medical device.

d. **Testing**

(1) **Materiel Test in Support of Joint Operational Plans and/or Service Requirements:**

No obligations were incurred.

(2) **Army Materiel Suitability Tests**

No obligations were incurred.

5. **TRAINING SUPPORT**

No obligations were incurred.

6. SIMULANT TEST SUPPORT - PE 65710, Project D049

The objective of this program are to plan, conduct, evaluate, and report on joint tests (for other than developmental hardware) and accomplish operational research assessments in response to requirements received from the Commanders-In-Chief and Services; to serve as the DOD joint point of contact for chemical and biological defense tests and technical data; and to publish and maintain the CB Technical Data Source Book.

During FY 89:

Weathering Factors: Completed a study of weathering factors under various climatic and operational conditions and evaluated the nature of surface types and their effects on relative persistence of chemical agents.

Quick Response and Planning Digest: Continued to provide quick responses in the form of literature searches and technical evaluations to inquiries from Department of Defense elements.

Joint Chemical Biological (CB) Technical Data Source Book: Continued the preparation of a series of volumes addressing the analysis of CB weapons and defense systems.

Chemical Protection Afforded by Standard Uniforms: Completed a study to define the protection levels against threat agents provided by standard clothing items and protective ensembles.

Effects of Extended Flight on Aircraft: Completed a study to determine levels of contamination expected after extended flights and any hazards associated with contamination.

Ship Vulnerability to Chemical Attack: Completed a study to evaluate naval ship vulnerability to chemical attack to validate a model.

Aircraft Decontamination: Completed testing to identify decontaminants, procedures for dispensing, and determining the amount(s) of water needed to

effectively decontaminate (both hasty and deliberate) aircraft and aerospace equipment under sortie surge conditions.

Outside Continental United States to Continental United States (OCONUS to CONUS): Completed a study to determine the procedures required to ensure that personal belongings and human remains may be returned to CONUS after exposure to CW/BW agents.

Mission Oriented Protective Posture (MOPP) Effects on Civilian Workforce: Completed an investigation on the effects of heat stress on people of advanced age while working and wearing full protective gear.

NBC Defensive Equipment Transport: Completed an investigation on the capabilities of units and individuals to transport NBC defensive equipment.

CW Risk Assessment Methodology for Special Operations Forces: Continued a project to provide special operations forces and other forces with a documented planning and operational tool to support operations in a chemical environment.

Helicopter Operations - Toxic Environment, UH-60 Blackhawk: Completed testing to determine interior hazard resulting from exterior exposure to agent in various situations (i.e. hovering, flying, and stationary).

Characterization of a Chemical Battlefield: Completed an evaluation of the chemical battlefield in terms of the expected contamination density and the duration of effects from threat munitions.

Operational Effectiveness Matrix, Individual Protection: Completed phase I of a study to predict battlefield situations in which troop performance is degraded more by wearing protective gear than by chemical agents.

Effects of Rapid Temperature Change on the MC-1 Bomb: Completed a study of the effects of extreme temperature changes experienced during flight and delivery and how they effect the toxicity and dispersal patterns of agents.

Shipboard Contamination Flow: Completed the second phase of a study to determine the time-history agent concentration over the inner and outer surfaces of a Navy ship to obtain model validation and verification.

Systems Integration. (Customer Funded)

The objective of this program is to expedite/ensure the application of protection and decontamination hardware onto combat and combat/support systems. Development of mission effective NBC systems architecture is a major thrust with associated actions toward incorporation of all aspects of NBC protection and survivability technology. Development of enhanced customer programs to address protection and decontamination needs of all Services, other government agencies, and allied nations is our goal.

During FY 89:

Addressed NBC survivability/sustainability readiness concerns to 32 major combat/combat support weapon systems managers.

Established applications, systems integration, and survivability programs with several major programs including: Unmanned Aerial Vehicle; Single Source Processor/Signal Intelligence System; Non-line-of-Sight System; Line-of-Sight Forward Heavy System; and Forward Area Air Defense Command Control and Intelligence System.

Received production funds from three project manager funded programs for Modular Collection Protection Equipment application.

SECTION II

OBLIGATION REPORT ON BIOLOGICAL DEFENSE RESEARCH PROGRAM

FOR THE PERIOD 1 OCTOBER 1988 THROUGH 30 SEPTEMBER 1989

DEPARTMENT OF THE ARMY

RCS: DD-USDRE (A) 1065

DESCRIPTION OF RDTE EFFORT FOR THE BIOLOGICAL DEFENSE RESEARCH PROGRAM

During FY 89, the Department of the Army obligated $81,522,000 for biological research investigations and the development and test of physical and medical defense systems.

FUNDS OBLIGATED

Current Fiscal Year	(CFY)	$ 75,445,000	
Prior Year	(PY)	6,077,000	
TOTAL		$ 81,522,000	In-House $45,064,000 Contract $36,458,000

Breakdown of Program Areas

1. **BIOLOGICAL DEFENSE RESEARCH**

a. Basic Research in Life Sciences	CFY	$ 855,000	
	PY	-0-	
		855,000	In-House $ 780,000 Contract $ 75,000
b. Medical Biological Defense	CFY	$ 15,164,000	
	PY	272,000	
		$ 15,436,000	In-House $ 9,837,000 Contract $ 5,599,000
c. Exploratory Development	CFY	$ 6,366,000	
	PY	-0-	
		$ 6,366,000	In-House $ 2,262,000 Contract $ 4,104,000
TOTAL: BIOLOGICAL DEFENSE RESEARCH	CFY	$ 22,385,000	
	PY	$ 272,000	
		$22,657,000	In-House $ 12,879,000 Contract $ 9,778,000

2.	**DEFENSE SYSTEMS**			
	a. Exploratory Development	CFY PY	$ 23,932,000 2,167,000	
			$ 26,099,000	In-House $16,402,000 Contract $ 9,697,000
	b. Advanced Development	CFY PY	$ 21,284,000 3,073,000	
			$ 24,357,000	In-House $12,549,000 Contract $11,808,000
	c. Full-scale Development	CFY PY	$ 6,133,000 365,000	
			$ 6,498,000	In-House $ 1,323,000 Contract $ 5,175,000
	d. Testing		-0-	
TOTAL:	**DEFENSE SYSTEMS**	CFY PY	$ 51,349,000 $ 5,605,000	
			$56,954,000	In-House $30,274,000 Contract $26,680,000
3.	**SIMULANT TEST SUPPORT**	CFY PY	$ -0- -0-	
			-0-	In-House $ -0- Contract $ -0-
4.	**MANAGEMENT AND SUPPORT**	CFY PY	$ 1,711,000 200,000	
			$ 1,911,000	In-House $ 1,911,000 Contract $ -0-

1. BIOLOGICAL DEFENSE RESEARCH

a. Basic Research in Life Sciences. Program Element (PE) 61102, Projects AH52 and A71A

The objective of this program is to support the Biological Defense Program and to maintain a technology base for nonmedical aspects of biological defense. Effort is also directed toward the appraisal of new concepts for the rapid detection, identification, and decontamination of and protection from biological threat agents.

During FY 89:

Isolated and characterized reactive substances from natural sources capable of neutralizing several biological surrogates. Identified derivatives of the reactive substances for further studies.

Improved testing of immunologically based biodetection systems by using pharmaceutical agents as safe simulants for real pathogens.

Initiated an investigation of the interaction of toxins with receptor proteins to identify the specific site and nature of the toxin-protein binding. Such data will be used to develop next generation chemical/biological agent detectors, as well as anti-venoms for medical use.

Established a program to investigate the application of artificial intelligence techniques to mass spectrometric detection of biological materials.

b. Medical Biological Defense. PE 61102, Project BS12

Basic Research

The objectives of the basic medical research efforts are to define the basic mechanisms of action and physiological effects of low molecular weight peptides and toxins; to determine the physiochemical nature of toxins of biological origin; to develop the medical technological base to medically counteract the threat posed by known or newly discovered agents of biological origin (toxins, bacteria, rickettsia, or viruses); and to exploit existing and new technologies for the development of generic drugs, vaccines, or other

therapeutic and prophylactic measures against these potential agents. This effort provides the basic scientific information necessary for the development of improved systems for the medical diagnosis, treatment, and prevention of biological agent casualties.

During FY 89:

Characterized a peptide fragment of ricin (biotoxin from castor beans) capable of eliciting protective immunity, and identified a therapeutic target site on the native toxin.

Produced and characterized monoclonal antibodies that neutralize the lethal factor component of anthrax toxin by preventing its binding to the protective antigen component of the toxin.

Identified and synthesized nontoxic analogs of conotoxin (biotoxin from snails) that block activity of the native toxin, which may lead to development of a generic vaccine against these types of toxins.

Determined, using X-ray crystallography, the crystal structure of mojave toxin, which will give important insights into the mechanism of action of toxins from this class of snake venoms.

Established an enzyme-linked immunosorbent assay (ELISA) for the detection of phospholipase-2 type snake neurotoxins at clinically significant levels.

Identified, from several different strains of Crimean-Congo hemorrhagic fever (CCHF) virus, polypeptides that are closely related; therefore, a single vaccine should protect against multiple strains of CCHF virus.

Demonstrated that antibodies directed at appropriate glycoproteins, in the absence of other specific immune effector mechanisms, are capable of providing protection from challenge with Crimean-Congo hemorrhagic fever virus.

Demonstrated, in experimental models, that post-exposure immunotherapy is effective in treatment of Crimean-Congo hemorrhagic fever virus infection.

Produced a potential vaccine candidate for Hantaan virus (which causes hemorrhagic fever with renal syndrome) using recombinant deoxyribonucleic acid (DNA) technology.

Determined that two different strains of hantaviruses display significant homology in regions of their glycoproteins that are important for immunity, thus supporting the concept that a single vaccine could be constructed to protect against multiple hantavirus strains.

Produced nucleic acid probes as highly precise diagnostic tools for identifying specific hantavirus strains as well as probes that cross-react with different strains.

Determined that several biological response modifiers, including interleukin-2, interferon, and transforming growth factor, play distinct and critical roles in modulating cellular infection and inflammation.

Investigated humoral and cellular immune responses to vaccinia virus protective peptides in model systems to better understand host responses to immunization.

Identified a specific vaccinia virus surface protein that is important in the development of vaccinia-specific antibodies.

c. Exploratory Development. PE 62622, Project A553 and PE 62786, Project AH98

The objective of this program is to support development of nonmedical defensive materiel against biological agents directed toward the appraisal of new concepts for the rapid detection, identification, decontamination and physical protection of/from biological threat agents.

During FY 89:

Completed an assessment of the biological agent challenge produced by threat artillery delivery systems.

Selected the Light Addressable Potentiometric Sensor technology for development as the biosensor in the BC Detector.

Retrofitted and equipped two phase II CB Mass Spectrometer demonstration units with pyrolyzers to effect detection and identification of biological materials.

Developed a test method for evaluating large fabric samples, (i.e., whole sleeves, gloves, or head gear), and garment closure samples against bacterial aerosol penetration.

Initiated testing against viral surrogates.

2. DEFENSIVE SYSTEMS

a. Exploratory Development. PE 62770, Project A871

The objectives of the exploratory development program are to develop safe and effective vaccines/toxoids against agents of biological origin that are potential threats; to develop novel anti-agent drugs by identifying potential targets for pharmacological intervention; to develop generic anti-agent drugs that have a broad spectrum of activity and are effective against entire classes of toxins or organisms; to investigate molecular and biological properties of agents and to identify characteristics useful for diagnosis, prophylaxis and therapy of associated diseases; to elucidate the pathogenesis of infections or intoxications induced with experimental aerosols to determine the sequence of events leading to protective immunity; to exploit biotechnological approaches to produce more effective and broad-spectrum vaccines; and to develop improved methods and technologies for rapid diagnosis and identification of biological agents.

During FY 89:

Developed enzyme-linked immunosorbent assay (ELISA) methods, based on both monoclonal and polyclonal antibodies, for identification of several non-protein, low molecular weight toxins in clinical samples.

Synthesized analogs of tetrodotoxin (from puffer fish) and saxitoxin (marine dinoflagellate) for evaluation as potential vaccine candidates.

Discovered the physiological parameters of microcystin, an algal hepatotoxin.

Determined that several compounds, some of which are licensed for use for other indications, were effective in reducing the toxicity of microcystin in model systems.

Developed procedures for the detection of metabolites of T-2 mycotoxin (fungal), some of which have equipotent toxicity, in urine.

Demonstrated the feasibility of oral and respiratory immunization using a live, attenuated vaccine candidate strain of Rift Valley fever virus.

Demonstrated that calcium is essential for toxicity of the lethal factor component of anthrax toxin, and that compounds that block the calcium channel protect cells from toxic injury when exposed to the toxin.

Demonstrated that several experimental live vaccine candidates, and candidate recombinant vaccines expressing the protective antigen component of anthrax toxin, were safe and effective. Demonstrated that if the recombinant vaccines were used in combination with an adjuvant, protection against lethal challenge in experimental models could be provided with only one dose, instead of multiple doses required with the current vaccine.

Determined that the Asian "tiger" mosquito, Aedes albopictus, which recently appeared in the U.S., is capable of transmitting Venezuelan equine encephalitis.

Developed a novel assay system using insects to study the effects of antiviral drugs on Crimean-Congo hemorrhagic fever and Rift Valley fever viruses.

Determined that satellite mapping of the breeding habitats of insect vectors of Rift Valley fever virus correlated well with the prevalence of infected vectors.

Tested over one thousand compounds against nine viruses, and identified a number of active compounds for further confirmative testing.

Developed new ELISA and in vitro colorimetric assay systems with improved sensitivity and specificity for testing potential antiviral drugs.

Evaluated all cumulative antiviral testing data obtained to date and identified over 200 compounds with activity warranting additional screening and development.

Showed that specific receptor antagonists and neurotransmitter analogs were effective in preventing neural injury induced by some physiologically active compounds.

Industrial Base for Biological Defensive Systems

b. **Advanced Development.**

Nonsystems. PE 63002, Project D807

The objectives of this program are to develop the laboratory methodologies necessary for pilot production of vaccines; to compare production methods to reduce production risks; to prepare initial large standard lots of drugs and vaccines against biological agents which are required to initiate a wide array of safety and efficacy laboratory studies necessary for regulatory approval; to perform requisite preclinical testing of drugs and vaccines necessary for their development into products usable in humans; and to develop, test, and perfect methods for rapid identification of potential biological agents.

During FY 89:

Produced a monoclonal anti-idiotype antibody against the T-2 mycotoxin (fungal) monoclonal antibody and used this antibody to protect mice against T-2 intoxication in the first successful demonstration of this approach with low molecular weight toxins.

Identified the protein component of Venezuelan equine encephalitis (VEE) virus likely responsible for neurotropism, and characterized the anatomical pathways by which this virus gains access to the central nervous system. Correlated these observations with the known inability of circulating antibodies to protect against VEE encephalitis.

Developed a radioimmunoassay for rapid diagnosis of saxitoxin (red tide) poisoning and successfully tested it in clinical samples obtained from a naturally occurring case.

Developed and tested several laboratory models for Crimean-Congo hemorrhagic fever in order to discover an adequate model for further development and testing of prophylactic and therapeutic measures.

Selected ribamidine for advanced pharmacokinetics testing in nonhuman primates because the absorption, distribution, metabolism and excretion of this class of compounds in humans can only be modelled in other primate species.

Demonstrated, in experimental models, that the immunoenhancer, Bacille Calmette Guerin, could significantly increase resistance to infection with the tularemia bacterium.

Evaluated the kinetics, magnitude, and specificities of antibody responses to vaccinia virus in soldier volunteers (after their routine smallpox vaccinations) in support of efforts to develop a new vaccinia immune globulin for treatment of disseminated vaccinia.

Produced monoclonal antibodies against tetrodotoxin (puffer fish toxin) that show protective activity in an experimental system.

Successfully field tested rapid diagnostic techniques, including recently developed nucleic acid probes, for acute cases of Rift Valley fever in an African outbreak.

Selected six promising compounds that showed significant in vivo antiviral activity for testing against ribavirin and each other.

Developed two in vivo models for evaluation of compounds active against vaccinia virus, and found three promising compounds.

Compared human and mouse adapted strains of recombinant vaccinia viruses for their ability to immunize mice against Hantaan virus proteins, and found them comparable.

Identified compounds active against Crimean-Congo hemorrhagic fever virus on the basis of prolonged survival and inhibition of virally induced pathogenesis.

Completed preclinical safety testing of a live, attenuated Rift Valley fever virus candidate vaccine, and demonstrated that the vaccine was protective against development of clinical disease after challenge with the naturally occurring virus.

Identified the molecular mutations responsible for the lack of virulence of the candidate, live Rift Valley fever virus vaccine strain. These data suggest that the characteristic of attenuation would be preserved even after natural recombination with wild-type virus.

Drug and Vaccine Development. PE 63807, Project D809

The objectives of this program are to develop feasible methodologies for production of drugs and vaccines to be used in protection and therapy against biological agents; to prepare pilot quantities of specific vaccines for human safety and efficacy testing; to conduct phase I and phase II clinical trials of drugs and vaccines developed for protection and therapy; and to develop prototype rapid identification and diagnostic systems to be used in the identification of biological agents in clinical samples.

During FY 89:

Evaluated three systems for rapid identification kits to assay for the presence of plague antigen.

Prepared small quantities of types F and G botulinum toxoids for initial testing in experimental models for incorporation into a heptavalent vaccine.

Continued to vaccinate "at risk" persons against Q-fever and evaluated efficacy of the killed vaccine.

Completed a phase I human use trial of the live attenuated Chikungunya vaccine and demonstrated that it is well tolerated in volunteers and that it elicits immunoglobulin-M and neutralizing antibodies in over 95% of the vaccinees.

Initiated a phase I clinical trial for a new tularemia vaccine with a modified production protocol.

Demonstrated efficacy in preclinical studies of a live, recombinant vaccine showing promise as a candidate for an improved human vaccine for Venezuelan equine encephalomyelitis.

c. **Full-scale Development. PE 64807, Project D847**

The objectives of this program are to standardize upon a single major production process adequate to produce substantial, sufficient amounts of a specific vaccine or drug to perform clinical (field) trials; to conduct clinical trials of drugs or vaccines for protection and therapy against biological agents; and to standardize a production process for a specific system for rapid identification and diagnosis of biological agents in clinical specimens.

During FY 89:

Transitioned the inactivated Rift Valley Fever virus vaccine to contingency fielding status.

Awarded a contract to prepare pilot lots of botulinum toxoids, types F and G.

Transitioned the equine encephalitis vaccines (Eastern, Western, and Venezuelan) to contingency fielding status.

Established an efficacy field trial for ribavirin treatment of hemorrhagic fever with renal syndrome.

Continued a phase III, double-blind, placebo-controlled clinical trial of Junin vaccine in areas of Argentina hemorrhagic fever, which is caused by the Junin virus.

Continued support of a production facility for experimental vaccines, monoclonal antibodies and other noncommercial research and diagnostic reagents that require specialized biocontainment facilities for their production.

d. Testing

No obligations were incurred.

3. SIMULENT TEST SUPPORT

No obligations were incurred.

4. MANAGEMENT AND SUPPORT. PE 62770, Project A3BL

The objectives of this program are to provide maintenance support of laboratories; to conduct studies and analyses in support of research and development programs; and to support military construction of research, development, test and evaluation facilities.

During FY 89:

Established a new outside continental United States laboratory to study hemorrhagic fevers.

Upon fielding of the nerve agent antidote, redirected that portion of the medical chemical defense program devoted to nerve agents to low molecular weight neurotoxins of biological origin.

Continued to provide necessary maintenance and improvements to biosafety levels 3 and 4 laboratories designed to ensure that they provide maximal possible protection for "at risk" personnel and the environment from hazardous agents of biological origins.

Continued major equipment purchases and upgrades to provide state-of-the-art laboratory equipment in support of Biological Defense Research Program.

ANNEX B

REPORT ON CHEMICAL WARFARE/BIOLOGICAL RESEARCH

1 OCTOBER 1988 THROUGH 30 SEPTEMBER 1989

DEPARTMENT OF THE NAVY

RCS: DD-R&E (A) 1065 (7040)

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT,
TEST AND EVALUATION FUNDS FOR THE PERIOD
1 OCTOBER 1988 THROUGH 30 SEPTEMBER 1989
REPORTING SERVICE: DEPARTMENT OF THE NAVY
DATE OF REPORT: 30 SEPTEMBER 1989
RCS: DD-R&E(A)1065(7040)

DESCRIPTION OF RDT&E,N EFFORT FOR THE CHEMICAL WARFARE/BIOLOGICAL RESEARCH PROGRAM

During FY89, the Department of the Navy obligated $ 15,211,000 for general research investigations, development and test of chemical warfare agents, weapon systems and defensive equipment.

FUNDS OBLIGATED
($000)

Current Fiscal Year	FY89	$ 14,828		
Prior Year	FY88	383	In-House $	8,244
TOTAL		$ 15,211	Contract $	6,967

Breakdown of Program Areas

1. CHEMICAL WARFARE PROGRAM				
a. Defensive Equipment Program	FY89	$ 14,828		
	FY88	383	In-House $	8,244
TOTAL		$ 15,211	Contract $	6,967
(1) Basic Research	FY89	$ 1,593		
	FY88	0	In-House $	278
TOTAL		$ 1,593	Contract $	1,315

(2) Exploratory Development	FY89	$	4,215		
	FY88		0		
				In-House $	2,384
TOTAL		$	4,215	Contract $	1,831
(3) Advanced Development	FY89	$	3,215		
	FY88		72		
				In-House $	2,466
TOTAL		$	3,287	Contract $	821
(4) Engineering Development	FY89	$	5,805		
	FY88		311		
				In-House $	3,116
TOTAL		$	6,116	Contract $	3,000
b. Offensive Equipment Program	FY89	$	0		
	FY88		0		
				In-House $	0
TOTAL		$	0	Contract $	0
(1) Basic Research	FY89	$	0		
	FY88		0		
				In-House $	0
TOTAL		$	0	Contract $	0

(2) Exploratory Development	FY89	$	0		
	FY88		0		
				In-House $	0
TOTAL		$	0	Contract $	0
(3) Advanced Development	FY89	$	0		
	FY88		0		
				In-House $	0
TOTAL		$	0	Contract $	0
(4) Engineering Development	FY89	$	0		
	FY88		0		
				In-House $	0
TOTAL		$	0	Contract $	0
2. BIOLOGICAL RESEARCH PROGRAM					
a. Defensive Equipment Program	FY89	$	0		
	FY88		0		
				In-House $	0
TOTAL		$	0	Contract $	0
(1) Biological Research	FY89	$	0		
	FY88		0		
				In-House $	0
TOTAL		$	0	Contract $	0

3. ORDNANCE PROGRAM

	FY89	$ 0	
	FY88	0	
			In-House $ 0
TOTAL		$ 0	Contract $ 0

EXPLANATION OF OBLIGATIONS

Chemical Warfare Program

Defensive Equipment Program

Basic Research

This effort supports development of a collective protection system against chemical and biological agents. New and different systems for scrubbing air streams are being sought. In addition to filtration and active filtration systems, it is necessary to explore the usefulness of systems in which incoming air is scrubbed by an electrical discharge.

Funding also supports development and optimization of new ionization techniques in mass spectrometry, which will permit sensitive and selective analysis of saxi-toxins and blue-green algal toxins.

Additionally, basic research into molecular recognition and catalytic destruction of potential threat agents is accomplished.

Exploratory Development

This effort evaluates the performance effect of acute and chronic exposure to chemical agents and defense drugs. Exploratory development also supports efforts on the following tasks:

- Threat and technology interface
- Development of new impregnants for activated carbon to provide enhanced protection
- Measuring and predicting absorption of vapors into sensor coating materials
- Evaluation of wind-driven aerosol penetration of Navy chemical protection overgarments
- Surface acoustic wave (SAW) device for detecting chemical warfare vapors
- Chemiresistor device for detecting chemical warfare agent vapors
- Capability assessments of forces afloat to the chemical/biological threat
- Battle area dense gas modeling for the US Navy
- Carbon degradation (weathering) in Naval environment
- Assessments of the performance of gas filters at high relative humidity
- Chemical vapor detection using optical waveguides
- Surface chemistry of absorbents
- Technology for a toxic solids point detector
- Aerosol scrubbers, advanced filtration technology
- Low temperature ozone enhanced oxidation catalyst
- Nuclear Magnetic Resonance imaging for activated carbon filter residual life
- Decontamination technology, lightweight/integrated suit technology
- Biological degradation of chemical warfare agents
- Physical protection technology, detection technology

Advanced Development

Funding supports advanced development for defense of the Navy and Marine Corps afloat and ashore against chemical and biological agents. This program includes defense of ships, aircraft ground crew protection, overseas shore bases, and interfaces among them. Developments are funded in areas of detection, collective protection, personnel protection, and decontamination.

Engineering Development

Funds supported the performance of engineering development for the Aircrew Eye/Respiratory Program. This entails demonstrating that the design meets specifications in performance, reliability, maintainability, survivability, supportability, and system safety, prior to the first major production decision.

Additionally, funds support mission accomplishment in a hostile chemical biological research (CBR) environment by developing equipment and procedures which provide effective CBR defense. This program develops protective clothing that minimizes degradation of personnel performance due to heat stress. It is also developing citadel areas for collective protection designed for new ships or backfit in selected compartments. Two basic types of detectors are being developed: long-range, early-warning and point-detectors which locate and identify local/surface contamination. Decontamination processes, substances and equipment will be provided to remove contaminants or detoxify personnel and material. Combinations of the products from these four areas provide systems for CBR defense.

ANNEX C

DEPARTMENT OF THE AIR FORCE

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1988 THROUGH SEPTEMBER 1989

RCS: DD-DDR&E(A) 1065

EXPLANATION OF OBLIGATIONS

Chemical Warfare Program

Defensive Equipment Program

Basic Research

Basic research in chemical defense is performed by the Army for the Air Force.

Exploratory Development

This program is evaluating new technology for shelter detection to monitor toxic safe and entry areas, chemical agent personal dosimeters, and simulant monitors. A concept was developed to provide a mobile shelter for fire fighters instead of trying to modify the Survivable Collective Protection System to accommodate fire fighters.

Advanced Development

The Contamination Control System Analysis continued into Phase IV, which, examines the flow of contamination information to determine the most mission effective solution. Toxicology testing is continuing on the primary uptake simulant, leading to approval for human use. The Multiman Intermittent Cooling System completed successfully Qualitative Operational Tests. The system provides filtered cooled air to personnel during rest periods from heavy work in chemical protective clothing. A study was performed to determine the effectiveness of various communication devices for personnel in chemical clothing working in a flight line noise environment. Advanced development test started on a detection device which uses the surface acoustic wave principle. The detector will be used in aircraft cockpits and collective protection shelters. A study was performed to determine the effectiveness of a mask fit test device in improving personal protection.

Engineering Development

The Aircrew Eye-Respiratory Protection (AERP) system for the KC-135E category completed engineering development flight testing in July. AERP integration testing for the OV-10A aircraft was completed in June. TAC approved initiation of operational testing of the AERP in the F-16. Engineering development started for AERP in the C-9 and B-1 aircraft. AERP integration testing for the AC-130H started in July. A contractor is surveying available disposable masks to find one that will satisfy Air Force requirements. Development and operational testing of an improved aircrew CB protective suit is complete. Specifications will be transferred to the Defense Personnel Support Center for procurement in FY90. A project was initiated to live agent test a commercially developed pressure swing adsorption device to certify it for use in a liquid oxygen plant and as a replacement for collective protection filtration systems. Support continued on an Army development of a non-aqueous decontamination system for avionics equipment. The Transportable Collective Protection System is undergoing development and operational testing.

EXPLANATION OF OBLIGATIONS

Chemical Warfare Program

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Basic Research

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OBLIGATION REPORT OF RESEARCH, DEVELOPMENT,
TEST AND EVALUATION FUNDS FOR THE PERIOD
1 OCTOBER 1988 THROUGH 30 SEPTEMBER 1989
REPORTING SERVICE: DEPARTMENT OF THE AIR FORCE
DATE OF REPORT: 30 SEPTEMBER 1989
RCS: DD-DDR&E(A) 1065

DESCRIPTION OF RDT&E EFFORT FOR THE CHEMICAL WARFARE PROGRAM

During FY89, the Department of the Air Force obligated $34,029,000 for general research investigations, development and test of chemical warfare defensive equipment.

FUNDS OBLIGATED
($000)

Current Fiscal Year	(CFY)	$ 16,719	
Prior Year	(PY)	20,791	
TOTAL		$ 37,510	In-House $ 2,842 Contract $ 13,877

Breakdown of Program Areas

1. CHEMICAL WARFARE PROGRAM

2	a. Defensive Equipment Program	CFY PY	$ 16,719 20,791	In-House $ 2,842 Contract $ 13,877
	Total		$ 37,510	
	(1) Basic Research	None.		

(2) Exploratory Development	CFY PY	$ 2,626 $ 4,574	In-House $ 0,053 Contract $ 2,573
Total		$ 7,200	
(3) Advanced Development	CFY PY	$ 4,695 $ 2,515	In-House $ 0,094 Contract $ 4,601
Total		$ 7,210	
(4) Engineering Development	CFY PY	$ 9,398 $ 13,702	In-House $ 2,695 Contract $ 6,703
Total		$ 23,100	
b. Offensive Equipment Program		None.	
2. BIOLOGICAL DEFENSE RESEARCH PROGRAM		None.